We claim:

1. A process for the preparation of polyisobutenylphenol-containing Mannich adducts by

a) alkylation of a phenol with polyisobutene having more than 70 mol % of vinylidene double bonds and a number average molecular weight of from 300 to 3000 at below about 50°C in the presence of an alkylation catalyst;

b) reaction of the reaction product from a) with

formaldehyde, an oligomer or a polymer of formaldehyde and

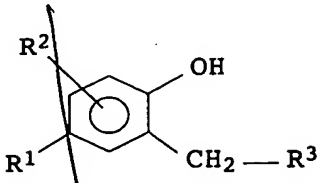
at least one amine which has at least one secondary amino function and no primary amino function
or

c) reaction of the reaction product from a) with at least one adduct of at least one amine which has at least one secondary or primary amino function and formaldehyde, an oligomer of formaldehyde, a polymer of formaldehyde or a formaldehyde equivalent.

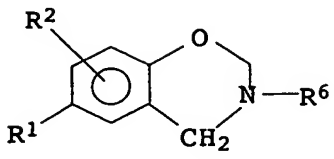
2. A process as claimed in claim 1, wherein the amine used is 3-(dimethylamino)-n-propylamine, di[3-(dimethylamino)-n-propyl]amine, dimethylamine, diethylamine, di-n-propylamine or morpholine.

3. A process as claimed in claim 1, wherein, in step c), the adduct used is an aminal of formaldehyde with a secondary amine, selected from di-C_1-C_8-alkylamines whose alkyl groups may be substituted by an $N(C_1$-C_4-alkyl$)_2$ group, and cyclic amines, which have 4 to 6 carbon atoms and whose cyclic structure may be interrupted by O and/or N-C_1-C_4-alkyl.

4. A process as claimed in any of the preceding claims, wherein an adduct mixture is obtained which comprises at least 40 mol% of compounds of the formula Ia and/or Ib,



(Ia)



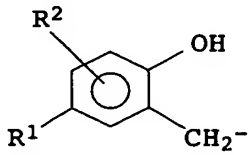
(Ib)

where

R^1 is a terminally bonded polyisobutenyl radical,

R^2 is H, C_1- to C_{20}-alkyl, C_1- to C_{20}-alkoxy, hydroxyl, a polyalkylenyl radical or $CH_2NR^4R^5$, where R^4 and R^5 have the meanings stated below, and

R^3 is NR^4R^5, where R^4 and R^5, independently of one another, are selected from H, C_1- to C_{20}-alkyl, C_3- to C_8-cycloalkyl and C_1- to C_{20}-alkoxy radicals which may be interrupted and/or substituted by heteroatoms selected from N and O, and phenol radicals of the formula II



(II)

where R^1 and R^2 are as defined above;
with the proviso that R^4 and R^5 are not simultaneously H or phenol radicals of the formula II; or R^4 and R^5, together with the N atom to which they are bonded, form a 5-, 6- or 7-membered cyclic structure which has one or two heteroatoms selected from N and O and may be substituted by one, two or three C_1- to C_6-alkyl radicals; and

R^6 is a radical R^4 or R^5 other than H.

5. A process as claimed in any of the preceding claims, wherein a Mannich adduct having a polydispersity of from 1.1 to 3.5 is obtained.

6. A process as claimed in any of the preceding claims, wherein, in step c), an adduct which is obtained from at least one amine and formaldehyde, an oligomer of formaldehyde, a polymer of formaldehyde or a formaldehyde equivalent by reacting the two reactants for at least 15 minutes at above +15°C is used.

7. A process as claimed in any of claims 1 to 6, wherein the reaction mixture from b) or c) is fractionated by column chromatography over an acidic stationary phase by multistage elution with

- at least one hydrocarbon and then
- at least one basic alcohol/water mixture.

8. A process as claimed in claim 7, wherein the basic alcohol/water mixture used is a mixture of

a) from 75 to 99.5% by weight of at least one C_2- to C_4-alcohol,
b) from 0.4 to 24.4% by weight of water and
c) from 0.1 to 15% by weight of at least one amine which is volatile at room temperature.

9. A process as claimed in any of the preceding claims, wherein the adduct mixture obtained includes from 0 to 20, preferably 1 to 15, mol% of polyisobutenylphenols from reaction step a) which are not reacted further.

10. A Mannich adduct obtainable by

a) alkylation of a phenol with polyisobutene having more than 70 mol % of vinylidene double bonds and a number average molecular weight of from 300 to 3000 at below about 50°C in the presence of an alkylation catalyst;

b) reaction of the reaction product from a) with formaldehyde, an oligomer or a polymer of formaldehyde and at least one amine which has at least one secondary amino function and no primary amino function.

11. The use of a Mannich adduct as claimed in claim 10 as a detergent additive in fuel and lubricant compositions.

12. An additive concentrate containing, in addition to conventional additive components, at least one Mannich adduct as claimed in claim 10 in amounts of from 0.1 to 99.9% by weight, preferably 0.5 to 80% by weight.

13. A fuel composition containing a main amount of a liquid hydrocarbon fuel and an amount, having detergent activity, of at least one adduct as claimed in claim 10.

14. A lubricant composition containing a main amount of a liquid, semisolid or solid lubricant and an amount, having detergent activity, of at least one adduct as claimed in claim 10.

15. The use of a fuel composition as claimed in claim 13 as a gasoline or diesel fuel

add A4

Preparation of polyisobutenylphenol-containing Mannich adducts

Abstract

Polyisobutenylphenol-containing Mannich adducts are prepared by

a) alkylation of a phenol with highly reactive polyisobutene at below about 50°C in the presence of an alkylation catalyst;

b) reaction of the reaction product from a) with

formaldehyde, an oligomer or a polymer of formaldehyde and

at least one amine which has at least one secondary amino function and no primary amino function,
or

c) reaction of the reaction product from a) with at least one adduct of at least one amine which has at least one secondary or primary amino function and formaldehyde, an oligomer of formaldehyde, a polymer of formaldehyde or a formaldehyde equivalent,

and are used as detergent additives in fuel and lubricant compositions, and additive concentrates, fuel compositions and lubricant compositions contain these Mannich adducts.